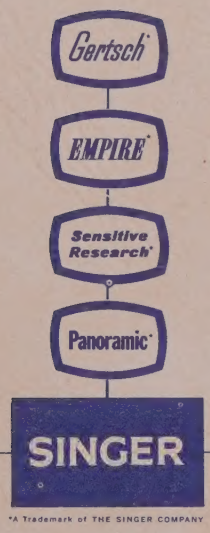
INSTRUCTION MANUAL

USATSG LIBRARY
FILE COPY

EMPIRE*

MICROWAVE IMPULSE GENERATOR

MODELS IG-118A AND IG-118B



Precision electrical and electronic instruments for measurement

THE SINGER COMPANY • METRICS DIVISION

INSTRUCTION MANUAL

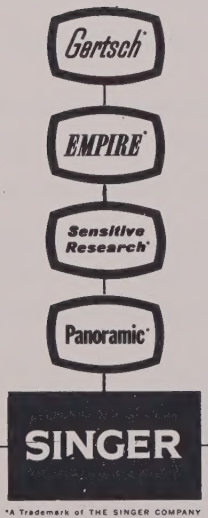
EMPIRE*

MICROWAVE IMPULSE

GENERATOR

MODELS IG-118A AND IG-118B

SERIAL NO.



*A Trademark of THE SINGER COMPANY

Precision electrical and electronic instruments for measurement

THE SINGER COMPANY • METRICS DIVISION

WARRANTY

THE SINGER COMPANY, METRICS DIVISION, warrants each new instrument to be free from defects in material and workmanship, effective after delivery to the original purchaser as follows:

*Commander** Instruments: Potentiometers, Bridges,
Volt Ratio Boxes and Standard Resistors.....5 years
*Sensitive Research** Electrical Indicating Instruments.....2 years
Other Electrical and Electronic Measuring Instruments.....1 year

Repair or replacement (at our option) without charge (F.O.B. factory) will be effected when our examination satisfactorily indicates that defects are due to workmanship or materials. Electron tubes, semiconductors, batteries, fuzes, lamps, thermoelements, and *RatioTran** potentiometers are excluded from warranty coverage. Warranty returns must first be authorized by the factory.

If the instrument or any portion thereof, has been abused, misused, damaged by accident or negligence, or if any serial number or seal has been removed or altered, the warranty is void.

This warranty is in lieu of all other obligations or liabilities expressed or implied and The Singer Company neither assumes, nor authorizes any person to assume for them, any other liability in connection with sales of instruments manufactured by The Singer Company, Metrics Division.

THE SINGER COMPANY • METRICS DIVISION
915 PEMBROKE STREET, BRIDGEPORT, CONNECTICUT • 3211 S. LA CIENEGA BLVD., LOS ANGELES, CALIFORNIA

*A Trademark of THE SINGER COMPANY

REPAIR AND MAINTENANCE

Instruments should be returned only on prior written authorization from the Singer Representative or the factory(1). Warranty repair will be made upon written request. Please provide the following information in order to expedite our processing of your instrument:

1. Model or Type
2. Serial Number
3. Description of trouble(2)
4. Test instruments used
5. Approximate date instrument was placed in operation
6. Approximate number of hours of use
7. Has maintenance action been previously requested?
8. Other comments

Upon receipt of this information our Service Department will send you service data or shipping instructions. Upon receipt of shipping instructions forward the instrument to the factory prepaid. If requested, an estimate of charges will be made before work begins.

(1) Contact Metrics Division, Bridgeport, Connecticut for *Commander**, *Empire**, *Panoramic**, and *Sensitive Research** instruments. Contact Metrics Division, Los Angeles, California for *Gertsch** instruments.

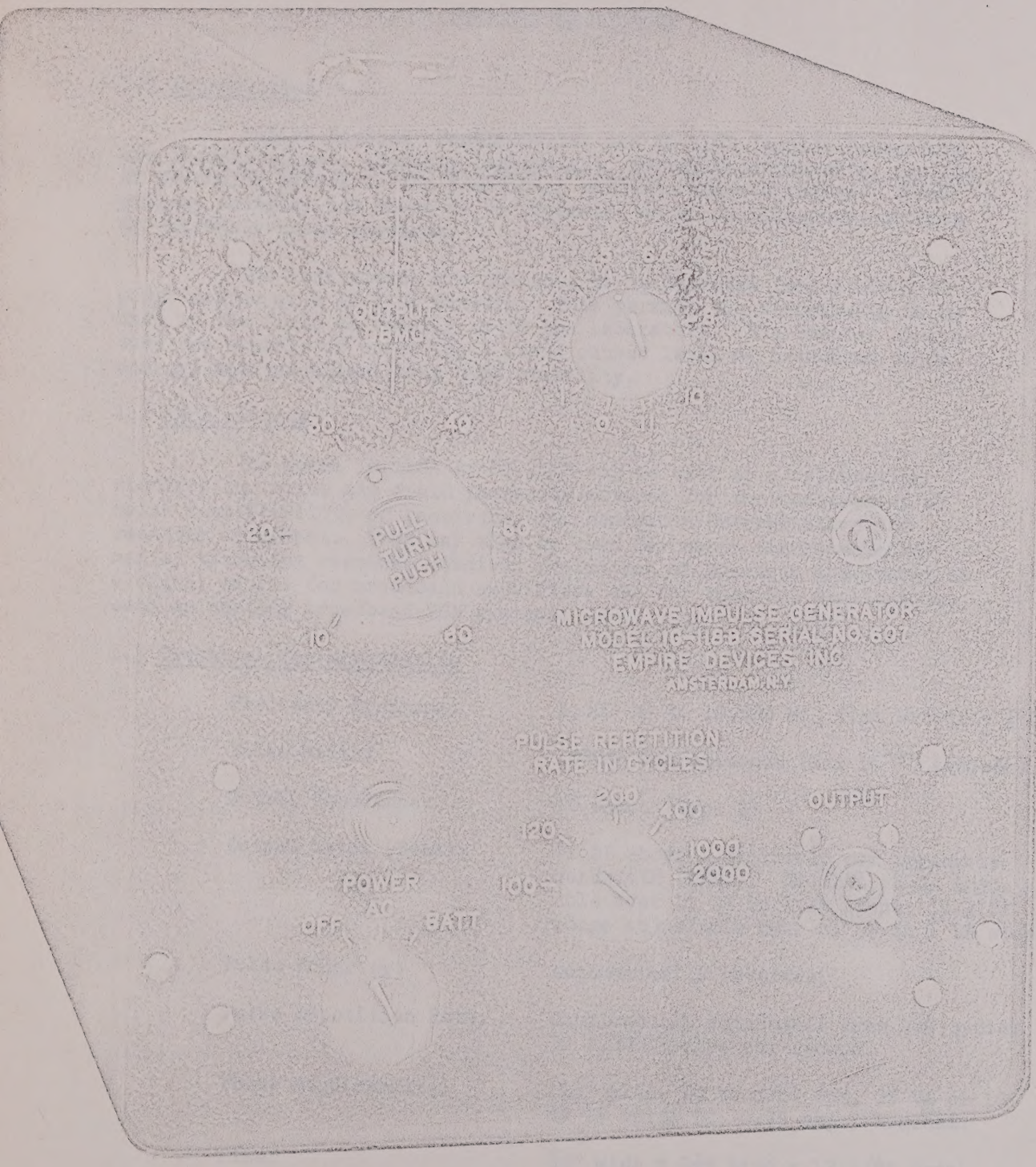
(2) Include data on symptoms, measurements taken, suspected location of trouble, maintenance action taken, and any other relevant data.

TABLE OF CONTENTS

	Page
LIST OF ILLUSTRATIONS	ii
SECTION I - GENERAL DESCRIPTION	1
1.1 Introduction	1
1.2 Applications	1
1.3 Technical Characteristics	1
SECTION II - OPERATING INSTRUCTIONS	2
2.1 Operating Controls	2
2.2 Operating Procedure	2
SECTION III - THEORY OF OPERATION	4
SECTION IV - MAINTENANCE	7
4.1 Test and Adjustment Procedures	7
4.1.1 Frequency Spectrum	7
4.1.2 Contact Behavior and Stability	7
SECTION V - SCHEMATIC DIAGRAMS	12

LIST OF ILLUSTRATIONS

Figure	Title	Page
3-1	Block Diagram, IG-118A	5
3-2	Block Diagram, IG-118B	7
4-1	Frequency Spectrum Test Set-up	8
4-2	Test Set-Up for Contact Adjustment	9
4-3	Oscillograms	10


PULL
TURN
PUSH
MICROWAVE IMPULSE GENERATOR
MODEL 10-100 SERIAL NO. 507
EMPIRE DEVICES INC
AMSTERDAM N.Y.
PULSE REPETITION
RATE IN CYCLES
OUTPUT
POWER
OFF
BATT

SECTION I

GENERAL DESCRIPTION

1.1 Introduction

Empire Devices' Models IG-118A and IG-118B Impulse Generators are transistorized, compact, lightweight, portable instruments, capable of producing pulses in the fractional millimicrosecond region. These pulses, normally too short to be presented on an oscilloscope, produce an extremely broad spectrum.

The instruments are designed to be operated from a 115 V AC power source or a 12 V DC battery. This permits the instruments to be used in the field as readily as in the laboratory. The impulse generators are capable of producing a known output level of broadband pulse energy, with excellent long time stability.

1.2 Applications

The Model IG-118A or IG-118B may be used as a calibrating standard for noise and field intensity meters; for the measurement of noise susceptibility of receivers; for bandwidth determination and receiver alignment. They may also be used for noise figure measurements; transient response studies; evaluation of spectrum analyzers; as a signal source for broadband amplifiers and for specific applications such as testing broadband ECM systems.

1.3 Technical Characteristics

Frequency Spectrum:	1,000 MC to 10,000 MC, flat within $\pm \frac{1}{2}$ DB.
Pulse Width:	.00005 microseconds (5×10^{-11} seconds).
Output Impedance:	50 ohms. (Type N)
Output Level (Peak):	71 DB above 1 microvolt per megacycle bandwidth (DBMC). IG-118A range adjustable over 11 DB in 1 DB steps; IG-118B range adjustable over 61 DB in 1 DB steps.
Pulse Polarity:	Automatically reverses.
Pulse Repetition Rate:	Continuously adjustable from 120 cycles to 2,000 cycles per second.
Power Requirements:	115 volts, 50 to 4000 cps, 25 VA or 10 to 15 volts DC, 0.75 amp., nominal.
Size:	$8\frac{1}{4}$" wide x $9\frac{1}{4}$" high x 13 1/8" deep.
Weight:	IG-118A - 14 lbs.; IG-118B - 17 lbs.

SECTION II

OPERATING INSTRUCTIONS

2.1 Operating Controls

CONTROL	FUNCTION
POWER-OFF; AC; BATT.	Applies power to the instrument from either an AC source of 115 volts, 50-400 cps or a 12 volt DC battery. Indicator lamp directly above the switch is illuminated when power is applied.
PULSE REPETITION RATE IN CYCLES	Used to set the pulse repetition rate of the impulse generator.
OUTPUT - DBMC	Selects the desired level of the output signal. In the IG-118A, a single control selects an output range of 60 to 71 DBMC. In the IG-118B, two controls are used to select the range of 10 to 71 DBMC.
CONTACT ADJUST	This control optimizes the contact spacing and is used to compensate for normal wear of the contacts.

2.2 Operating Procedure

a. To operate from an AC source of power, plug the line cord into a suitable outlet. Rotate the power switch to AC.

b. To operate from a DC source of power, do not plug in the AC line cord. Connect the battery to the terminals in the rear of the instrument. Observe polarity; that is, connect the positive lead to the red terminal. If the polarities are reversed, the instrument will not operate. Damage to the instrument due to reversed polarity is prevented by the use of a series diode.

c. Connect a 50-ohm coaxial cable from the output connector on the front panel to the device under test.

d. Adjust the output-DBMC controls to obtain the desired output level.

e. Adjust the PULSE REPETITION RATE IN CYCLES control for the desired pulse repetition rate. (Normally that which most nearly matches the PRR otherwise being received.)

f. The contact adjust control is factory-set to the proper position. To confirm that the setting is proper, connect the output terminal of the IG-118 to a receiver having an audio output and adjust the receiver gain and volume to obtain an audible tone. Rotate the contact adjust control fully clockwise; then, rotate it slowly counter-clockwise until the clearest tone is heard in the receiver.

SECTION III

THEORY OF OPERATION

The models IG-118A and IG-118B produce extremely short pulses which provide a uniform spectrum over the frequency range from 1,000 to 10,000 megacycles per second. The impulses are generated by the abrupt discharge of a charged section of coaxial line. Block diagrams of the impulse generators are shown in Figures 3-1 and 3-2.

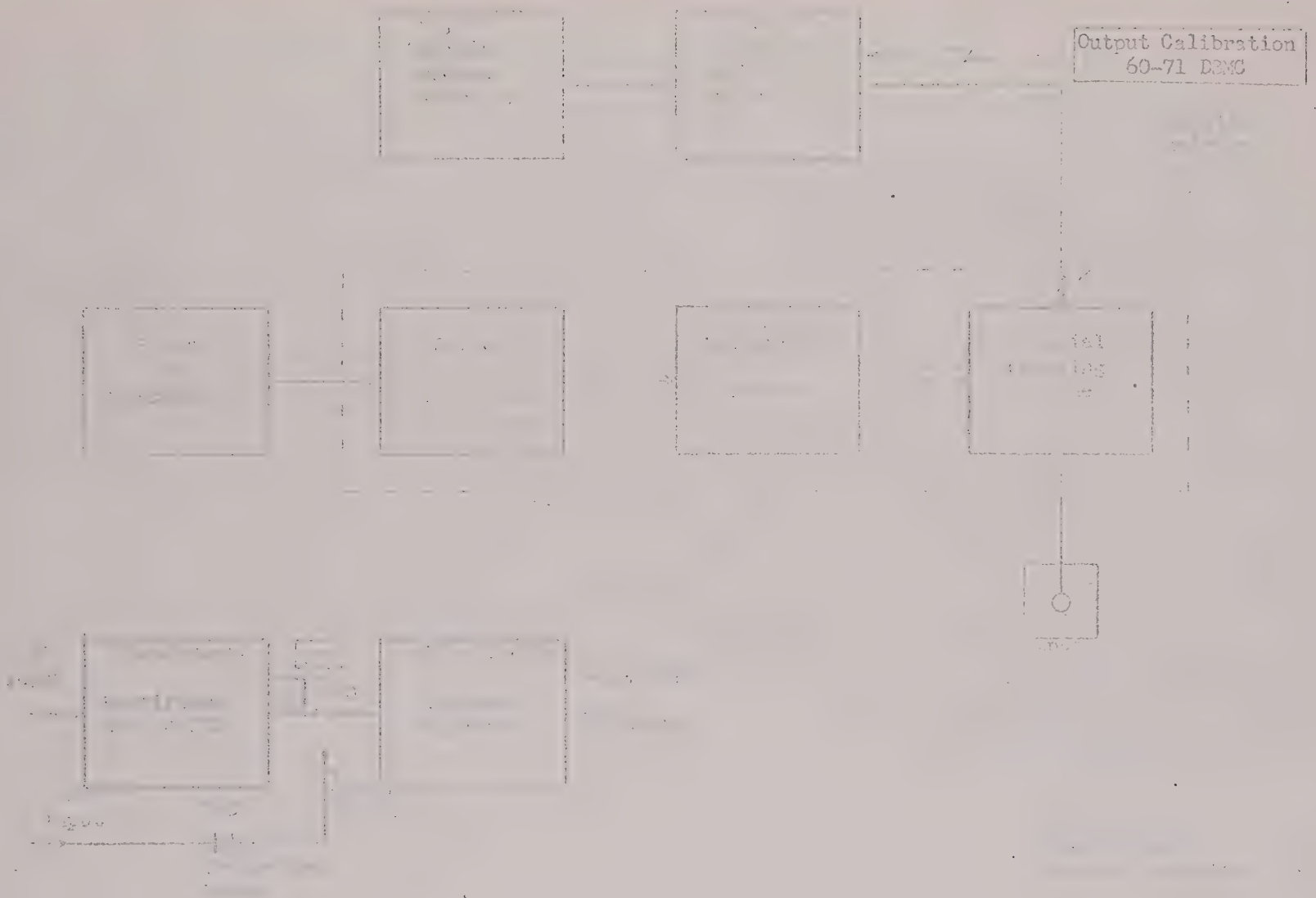
The regulated power supply furnishes +6.3 volts to the transistor circuits of the impulse generators. The regulated supply is isolated from ground to permit grounding on either side. Two silicon diodes, CR1 and CR2, act as a full wave rectifier for the AC input voltage. Silicon diode CR3 is a polarity protective device, placed in the positive DC input line to protect the transistors in the event the battery is inadvertently reversed. Regulation is accomplished by means of a reference diode, CR4, a series regulating transistor, Q2, and an amplifier transistor, Q1. Potentiometer R3 is connected across the +6.3 volt output to provide a feedback voltage for comparison against the reference diode.

The rate at which the impulse generator drivers act to discharge the coaxial line is determined by the pulse repetition rate generator. This generator consists of two transistors, Q3 and Q4, operating as a free-running multivibrator. The repetition frequency is adjusted by means of the PULSE REPETITION RATE IN CYCLES control on the front panel. This control is a ganged, dual potentiometer, R6 and R7, which varies the time constant in the bias circuits of the transistors.

The impulse generator drivers, Q5 and Q6, produce a square wave at a frequency determined by the pulse repetition rate generator, which drives the mechanical vibrator. The 55 CPS square wave charging voltage produced by transistors Q7 and Q8 is applied through a charging resistor, thereby charging the coaxial line alternately positively and negatively. The mechanical vibrator discharges the line, at the pulse repetition rate, into a discharge line to produce the impulses.

Provision is made in both the IG-118A and IG-118B for controlling the output level. In the IG-118A, this is accomplished by a single OUTPUT-DBMC control, calibrated from 60 to 71 DBMC, located on the front panel. This switch controls a precision voltage divider connected between the secondary of the charging voltage transformer and the charging resistor, which is located in one contact arm of the mechanical vibrator. This control varies the charging voltage in 1 DB steps, thus controlling the output level over an 11 DB range.

The output level of the IG-118B is controlled by the combination of a voltage divider identical to that described above and an RF step attenuator. The voltage divider is calibrated from 0 to 11 DBMC. The RF step attenuator is calibrated from 10 to 60 DBMC. The sum of the two settings is the final output, thus providing adjustment from 10 to 71 DBMC in 1 DB steps. The RF step attenuator covers its range in six 10 DB steps. It is located between the impulse generator and the output terminal of the instrument.


Output Calibration
60-71 D3MC

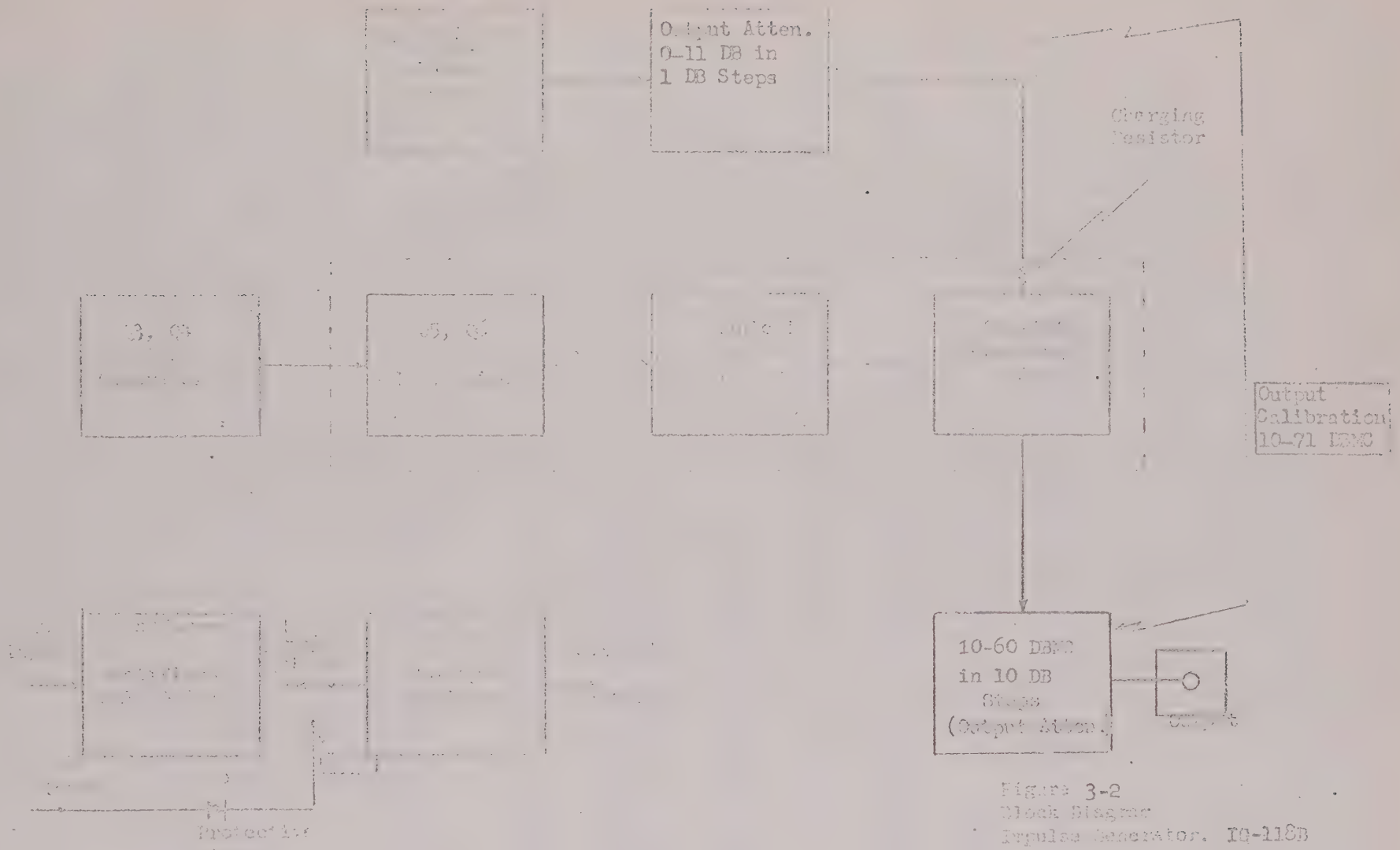


Figure 3-2
Block Diagram
Impulse Generator, IG-118B

SECTION IV

MAINTENANCE

4.1 Test and Adjustment Procedures

4.1.1 Frequency Spectrum

a. Using the test set-up illustrated in Figure 4-1, complete the following steps to compare the amplitude level of the Impulse Generator with that of a pulse-modulated CW source.

b. Set the double pole-double throw coaxial switch to connect the Impulse Generator to the sensitive receiver.

c. Observe the output of the Impulse Generator on the panoramic display, and adjust the OUTPUT DBMC controls to obtain a reference reading.

d. Rotate the coaxial switch to connect the pulse-modulated signal generator to the sensitive receiver.

e. Tune the signal generator to the frequency of the receiver and adjust the power setting controls of the signal generator to calibrate its output.

f. Adjust the signal generator variable attenuator to obtain the same reference level as that obtained with the Impulse Generator step C above. The dial setting of the variable attenuator is an indication of the relative output spectrum of the Impulse Generator.

g. Follow the above procedure for test frequencies in whatever increments are desired.

4.1.2 Contact Behavior And Stability

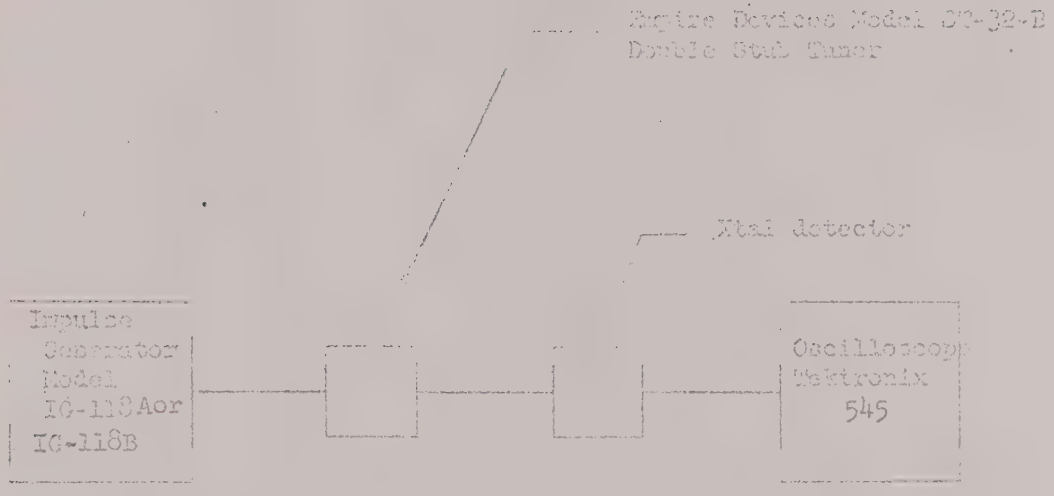
a. Connect the Impulse Generator through an Empire Devices Model ST-32-B Double Stub Tuner and a crystal detector, into a high speed oscilloscope such as a Tektronix Model 545 as shown in Figure 4-2.

b. Turn the CONTACT ADJUST control fully clockwise with a screwdriver, thus opening the contacts.

c. Adjust the PULSE REPETITION RATE IN CYCLES control to approximately 2000 CPS. At this time, the "buzzing" of the generator should be distinctly audible.

d. Watching the oscilloscope screen, slowly advance the CONTACT ADJUST control until an output appears on the screen similar to that illustrated in Figure 4-3 (A).

6 DD Rad, Radio
Devices Model AT-5)



for contact adjustment

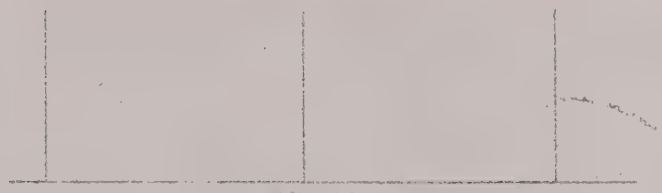


Fig. 4-3 (A)

Fig. 4-3 (B)

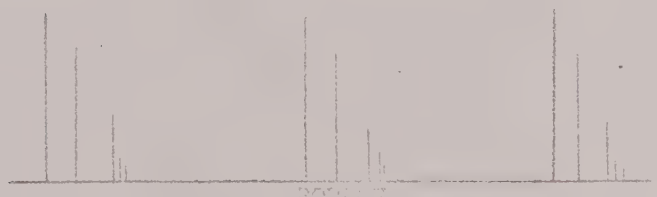


Fig. 4-3 (C)

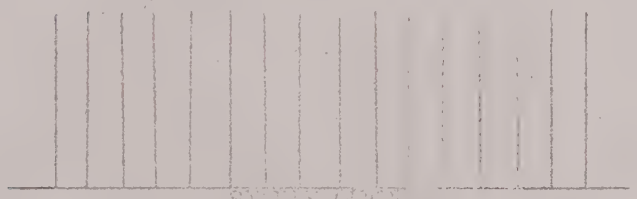


Fig. 4-3 (D)

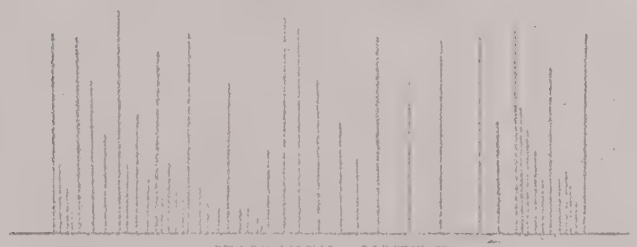


Fig. 4-3 (E)

NOTE:
A. Normal Contact Behavior
B. Arcing at Contacts: Contacts not Touching
C. Bouncing Contact: Contacts too Close
D. Stable Output: Damped Transducer
E. Unstable Output: Undamped Transducer

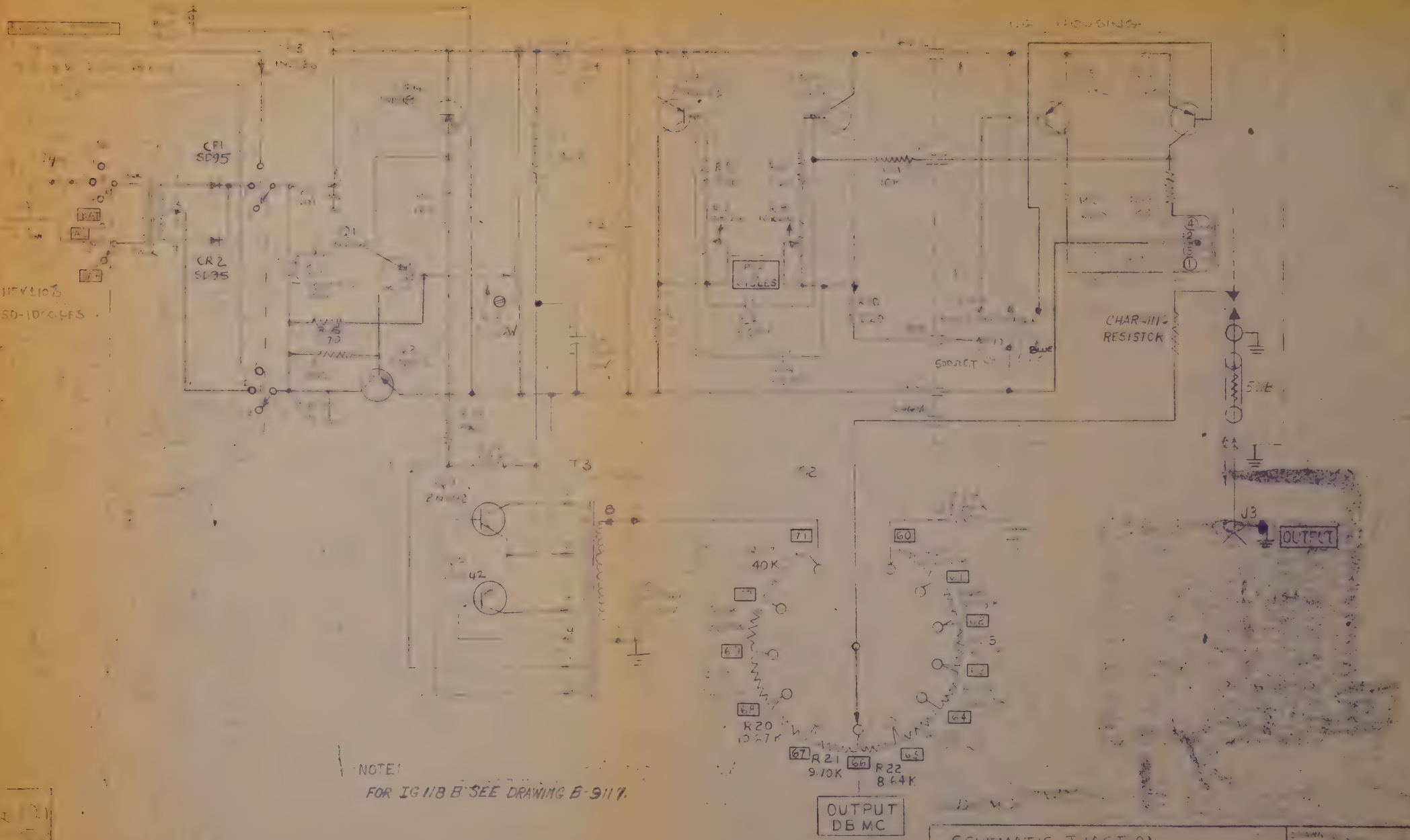
Figure 4-3

e. Vary the PULSE REPETITION RATE IN CYCLES control from 100 to 2000 and observe the oscilloscope for a clean output over this range.

Since it is impractical for the contacts to be continuously monitored by means of an oscilloscope, the operator should familiarize himself with the aural tone which accompanies a clean output and readjust the CONTACT ADJUST control for this tone whenever it is required.

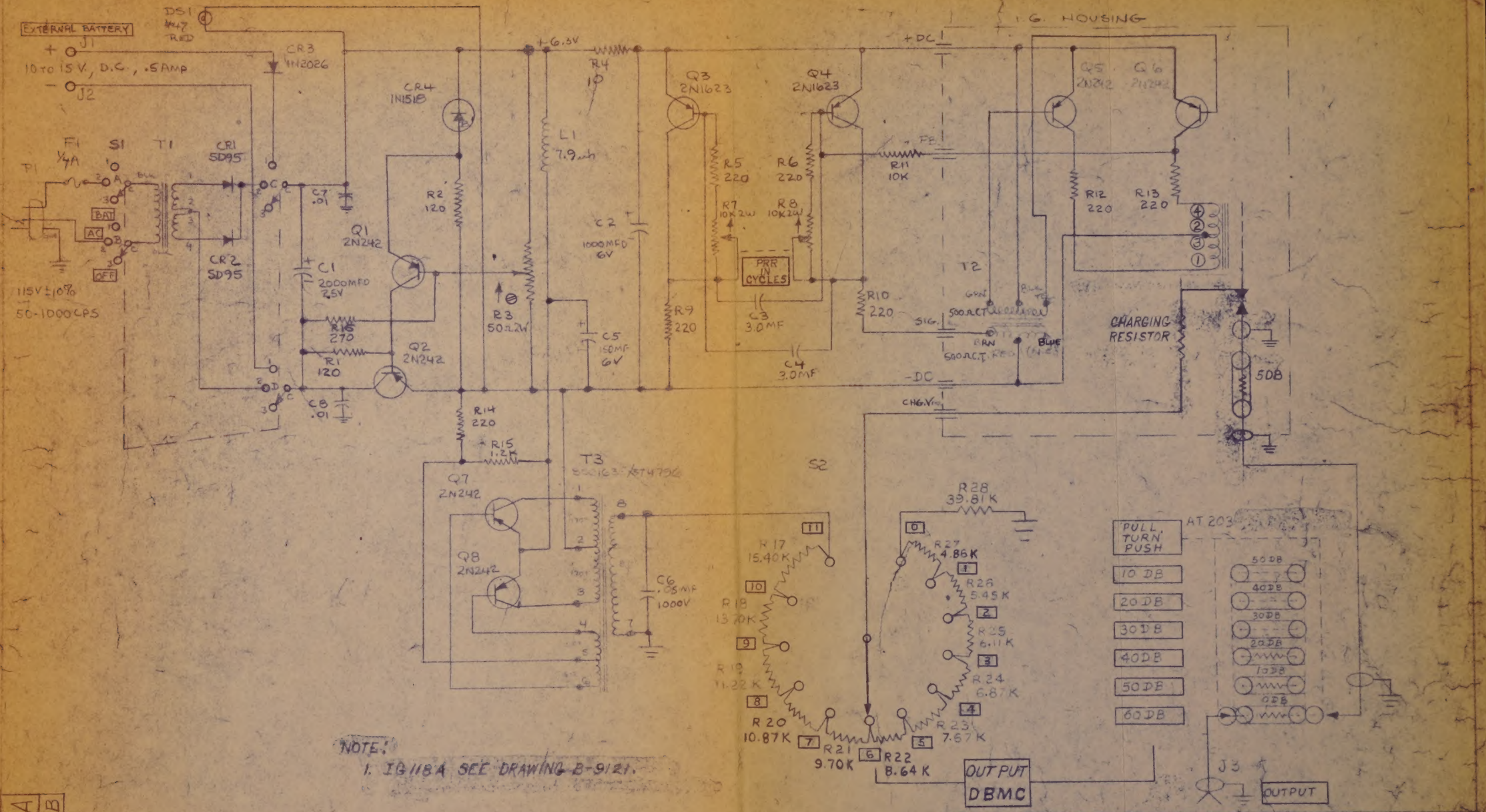
SECTION V

SCHEMATIC DIAGRAMS



SCHEMATIC DIAGRAM
IG-118A

C-9121 B



NOTE:
1. IG118A SEE DRAWING B-9121.

PL-9100

SCHEMATIC DIAGRAM
IG118B

THE SINGER COMPANY, METRICS DIV.
BRIDGEPORT, CONN. U.S.A.

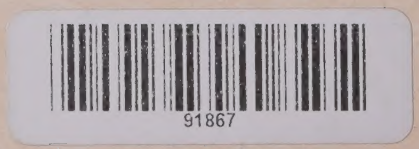
DRAWN
APP'D
11-14-61

009117

ISSUE B

REF. 9117

A | B


91867